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September 15, 1965
REIC Memorandum 26

RADIATION EFFECTS ON GLASS:

AN ANNOTATED BIBLIOGRAPHY

RADIATION EFFECTS INFORMATION CENTER

BATTELLE MEMORIAL INSTITUTE

COLUMBUS, OHIO 43201

The Radiation Effects Information Center has been established at Battelle Memorial Institute by the United States Air Force and the National Aeronautics and Space Administration to provide a means of placing radiation-effects data in the hands of designers and those conducting research and development. Access to the Center and to its reports is obtained through the Air Force. This report has been prepared pursuant to the provisions of Contract No. AF 33(615)-1124 (Continuation of AF 33(657)-10085), BPSN Nrs. 64-6899 7381 738103 and 64-6399 7634.

RADIATION EFFECTS ON GLASS: AN ANNOTATED BIBLIOGRAPHY

compiled by

B. A. Gilmour and W. F. Heenan

INTRODUCTION

This bibliography includes information on the radiation effects on glass, glass devices, and glass dosimeters that has been processed by the Radiation Effects Information Center since 1958.

For information on the radiation effects on glass processed by the Center before 1958, consult REIC Technical Memo No. 9, which is available from the Defense Documentation Center, Cameron Station, Alexandria, Virginia, as AD 207701.

Joseph A. Aboaf, J. Raymond Hensler, Norbert J. Kreidl, and Eberhard Lell
IRRADIATION DAMAGE TO GLASS
Bausch & Lomb Inc., Rochester, N. Y., TID-17227, Oct., 1962, AT(30-1)-1312, 44 pp
(Accession No. 19539)

Investigation of space charge buildup in electron- and gamma-irradiated lead silicate, phosphate, silica and pyrex glass including measurement of dielectric properties and DC conductivity of exposed glasses was continued.

Joseph A. Aboaf, J. Raymond Hensler, Norbert J. Kreidl, Eberhardt Lell and Joseph L. Rood
IRRADIATION DAMAGE TO GLASS
Bausch and Lomb Inc., Rochester, N. Y., TID-14482, Nov., 1961, AT(30-1)-1312, 23 pp
(Accession No. 17689)

Discharge experiments on electron-irradiated lead silicate glasses were performed. Electrical discharge in glass following gamma irradiation was found to occur only when the gamma beam strikes the glass from one direction only. Dielectric constants were measured for irradiated glass. Studies were also made of irradiation of highly compressed glass. Specimens were irradiated in a Van de Graaff accelerator for 20 minutes with a 1 u A beam of 1 Mev electrons.

Perry B. Alers, U. S. Naval Research Laboratory, Washington, D.C.
MAGNETO-OPTIC STUDIES ON RADIATION-DARKENED CERIUM GLASS
Bulletin of the American Physical Society, Vol. 6, No 2, Ser. 2, 20 March 1961, pp 177-178
(Accession No. 14066)

The addition of cerium to glass tended to inhibit the darkening experienced by the glass when exposed to prolonged gamma radiation.

R. E. Alley, Jr.
IN-PILE MEASUREMENTS ON CAPACITORS
Bell Telephone Laboratories, Inc., Whippany, N. J., 31 Dec. 1958, 10th Qtr. Rpt., 15 Sept.-15 Dec. 1958, Pt. 3, Appendix A, AF 33(600)32662, pp 15-22
(Accession No. 9519)

In-pile measurements have been made on four samples of each of the following capacitors: Western Electric Hermetically Sealed Solid Electrolytic, Western Electric Polystyrene, Sprague Hyrel, and Corning Glass. The integrated epicadmium flux to which the samples were subjected was 2.5×10^{17} neutrons/cm^2. By means of forced air cooling, the temperature in the vicinity of the samples was held below 70°C throughout the experiment. The glass capacitors showed very uniform behavior. While the capacitance changes under irradiation were beyond the acceptable limits for precision capacitors in tuned circuits, they should prove acceptable in other applications.

D. G. Anderson, J. Dracass, T. P. Flanagan, and E. H. Noe (Brit. Sci. Inst. Res. Assoc., Chislehurst, Engl.)
APPLICATION OF GLASS SCINTILLATORS FOR THE DETECTION OF NEUTRONS AND OTHER TYPES OF NUCLEAR RADIATIONS.
Tech. Papers Intern. Congr. Glass, 6th, Washington, D.C. 1962, 429-41
(Accession No. 21906)

The compounds and preparations of some typical glass scintillators ard described. Efficiencies of detectors constructed from these glasses are given, with particular reference to the detection of thermal η, α-particles, and γ-radiation. The prepn. of glass scintillator fibers is described, and their use in scintillation track chambers is discussed. Possible future applications of glass scintillators in cathode-ray tubes, x-radiology, and η diffraction are discussed.

Raymond L. Arnett, Eugene D. Guth, and Julius R. Berreth
A CALORIMETRIC STUDY OF TRAPPED RADICALS PRODUCED BY GAMMA RADIATION
Phillips Petroleum Co., R & D Dept., Bartlesville, Okla., AFOSR-TN-59-894, Sept. 1959, AF 49(638)-45
Available: ASTIA, AD 235427
(Accession No. 12320)

Ammonia-Water-Acetone Glass

The composition of the glass is ammonia:water:acetone in the mol ratio 1:1.25:0.096; it gave a spectrum similar to that reported (15) when irradiated and examined at 77°K. Three irradiations have been examined for this glass--Runs 68 and 69 were at 77° and Run 70 at 4°K. Run 68 was given a dose of 1360 joules per gram with a flux of 5.8×10^{-3} watt per gram; the temperature rise of the sample during irradiation was 6 degrees. The corresponding values for Run 69 are: dose, 11,100 joules per gram; flux, 19×10^{-3} watt per gram with an extimated temperature rise of 21 degrees. The helium temperature Run 70 was given a dose of 160 joules per gram using a flux of 3×10^{-3} watt per gram; the temperature rise was 6.3 degrees.

Gregory Arutunian and Fred L. Seppi
THE EFFECTS OF IONIZING RADIATION UPON TRANSPARENT MATERIALS
Ordnance Tank-Automotive Command, Detroit Arsenal, Center Line, Michigan, RR-1, 26 October 1959
Available: ASTIA, AD 229629
(Accession No. 11643)

The materials studied in this research were commercial-grade glass, polystyrene, allyl carbonate, and plexiglas. Samples were exposed for ten hours to x-radiations of 50, 75, 100, 125, and 150 KVP. Coloration of plexiglas and glass depends both upon the energy of a polychromatic x-ray beam and upon the dosage incident on the sample.

Saara Asunmaa and Tryggve Baak, Owens-Illinois Glass Co., Technical Centre, Toledo, Ohio
IRRADIATION OF GLASS FILMS WITH A 100 KV ELECTRON BEAM
Physics and Chemistry of Glasses, 3, (2), April, 1962, pp 46-49
(Accession No. 20610)

A direct electron microscopic observation of the crystallization of thin films of baria titania alumina silica glass is experimental evidence for the fact that an energy barrier prohibiting the crystallization of thin glass films can be overcome by means of irradiation of the sample with a 100 kV electron beam.

P. B. Ayscough and H. E. Evans, The University of Leeds, Eng.
ELECTRON SPIN RESONANCE STUDIES OF γ-IRRADIATED OLEFINS AND u.v.-IRRADIATED METHYL IODIDE + OLEFIN GLASSES
Transactions of the Faraday Society, 60, (497), Pt. 5, May, 1964, pp 801-808
(Accession No. 25285)

γ-Irradiation of solid olefins at -196°C results in the trapping of a variety of paramagnetic species which have been identified by means of electron spin resonance observations. Some preliminary observations on the u.-v. photolysis of methyl iodide in solid olefins are reported.

F. Balestic, P. LeClerc, and Mlle. Bonnaud, Centre etudes nucleaires, Saclay, France
USE OF GLASSES AS INDUSTRIAL DOSIMETERS
Comm. energie at. (France) Rappt., No. 1213, 1959, (CA, Vol. 54, #15, 10 Aug. 1960, p. 14925)
(Accession No. 12553)

Squares of glass 15 mm. x 15 mm. and 1 mm. thick (compn.: SiO_2 70, Na_2O 18, CaO 10, MgO 1, B_2O_3 1, and Co_3O_4 0.5%) were irradiated to doses between 10^4 and 10^6 rep with Co-60 γ-rays and the resultant changes in optical d. (for a wave length of 4000 A.) observed in a spectrophotometer. Thermal treatment (130°) of the glass after irradiation did not entirely eliminate color instability nor did storage at 0°.

R. D. Baybarz
THE EFFECT OF HIGH ALPHA RADIATION ON THE CORROSION OF METALS EXPOSED TO CHLORIDE SOLUTIONS
Union Carbide Corp., Oak Ridge National Laboratory, Oak Ridge, Tenn., ORNL-3265, April 10, 1962, W-7405-eng-26, 9 pp
Available: OTS
(Accession No. 17105)

Corrosion tests were made on various materials exposed to chloride solutions containing high concentrations of Am-241 to determine the effect of alpha radiation on corrosion rates. The tests were made with an alpha activity level of 2 watts/liter. Pyrex and soft glass coupons showed corrosion rates of <1 mpy as determined by weight loss. The samples were exposed for 600 hr with no noted effects in either the control or the test solutions.

K. Becker (Kernforschungsanlage Julich, Ger.)
PHOSPHATE GLASS DOSIMETER FOR ROUTINE PERSONAL DOSE CONTROL IN NUCLEAR TECHNOLOGY INSTALLATIONS.
Nukleonik, 5: 154-9 (June 1963) (In German)
(Accession No. 22226)

The measurement of radioinduced fluorescence (radio-photoluminescence) in silver-phosphate-containing dosimeter glass was proved to be a method superior to that using photographic film for routine control of the radiation burden in nuclear technology installations. Sensitivity, preliminary dose, accuracy, time and temperature effects, energy and direction dependence of various glass-metal filter combinations, and neutron sensitivity, as well as various interfering influences, were investigated.

J. T. Bevans and A. D. LaVantine
SATELLITE MATERIALS AND ENVIRONMENTAL CONTROL SYSTEMS INVESTIGATIONS
Space Technology Labs., Inc., Los Angeles, Calif., AFEMD-TR-60-111, 1 January-30 June 1960, AF 04(647)-309
Available: AD 247018
(Accession No. 14194)

Thermal protection of solar cells has been partially effected by covering the cells with thin glass which is not entirely satisfactory as the glass may be damaged by micrometeorites, and the consequent damage area would be greater than the immediate impact area. The loss in transmission of a pitted or cracked glass cover would result in a reduced cell output. The effects of damage to glass were determined.

J. T. Bevans, A. D. LeVantine, and E. E. Luedke
SATELLITE MATERIALS AND ENVIRONMENTAL CONTROL SYSTEMS INVESTIGATIONS
Space Technology Laboratories, Inc., Los Angles, Calif., STL/TR-60-0000-19423, AFBMD-TR-61-12, Dec. 31, 1960, Final Rpt., July 1 - Dec. 31, 1960, AF 04(647)-619
Available: ASTIA, AD 255968
(Accession No. 14781)

Spectral reflectances of approximately 30 different surfaces were measured, and the computed solar absorptances are reported.

D. S. Billington and J. H. Crawford, Jr.
SOLID STATE DIVISION ANNUAL PROGRESS REPORT
Union Carbide Corp., Oak Ridge National Laboratory, Oak Ridge, Tenn., ORNL-3480, Aug. 23, 1963, Annual Prog. Rpt., Period Ended May 31, 1963, W-7405-eng-26, 158 pp
(Accession No. 23084)

EFFECTS OF IRRADIATION ON POLARIZATION CURRENTS IN GLASS R. A. Weeks

It was shown that the strengths of these polarization processes were enhanced by gamma-ray irradiation up to a dose of $\sim 10^7$ r. For higher doses a decrease in the strengths of some of these processes took place, although the particular polarization processes associated with the decrease have not been resolved.

Adli M. Bishay (Argonne National Lab., Ill.)
ANOMALOUS GAMMA-RAY INDUCED COLOURING OF SOME GLASSES CONTAINING CERIUM
Phys. and Chem. Glasses, 2: 169-75 (Oct. 1961)
(Accession No. 17165)

A new color center giving an absorption band at about 1.9 ev (650 mμ) was shown to be induced by gamma radiation in certain borate and silicate glasses containing cerium, most of which is in the cerous state.

Adli Bishay (to U.S. Atomic Energy Commission)
γ-RADIATION DOSIMETER GLASS
U.S. 3,089,957 (Cl. 250-83), May 14, 1963, Appl. Dec. 23, 1960; 4 pp
(Accession No. 21844)

Bi_2O_3 90.86, sand 7.8, boric acid 72.34, PbO 29, and As_2O_3 4.11 g. were mixed and sintered at 500° for 1 hr. The sintered mass was melted in a Pt crucible at 1230° for 5.5 hrs. and cast in Cu molds as 0.75 x 0.33-in. disks. The disks were annealed at 380°, cooled at 0.4°/min., ground, and polished to 1 and 3 mm. thickness.

These disks, exposed to γ-radiation doses and then heated at 130° for 1 hr., gave an absorbance at 515 mμ proportional to the dosage received.

Adli M. Bishay (Argonne National Lab., Ill.)
A REVIEW OF SOME GAMMA RADIATION EFFECTS ON GLASS (TID-17776)
Oct. 1962, contract W-31-109-eng-38, 27 pp (UAC-7008)
(Accession No. 20448)

Characteristic optical absorption bands are induced in glass subjected to ionizing radiation. Different factors affecting the induced absorption are discussed.

Adli M. Bishay (American Univ., Cairo) and K. R. Ferguson
GAMMA-RAY-INDUCED COLORINC OF GLASSES IN RELATION TO THEIR STRUCTURE
"Advances in Glass Technology" New York, Plenum Press, Inc., 1962 pp 133-48 (TID-15294)
(Accession No. 20757)

Optical absorption induced by ionizing radiation in glasses of different compositions was resolved into Gaussian-shaped bands in the range 1 to 6 ev. The differences in the position and intensity of the bands in silicate, borate, phosphate, and germanate glasses is partly ascribed to the difference in their structure.

G. E. Blair, Bausch & Lomb Co., Rochester, N.Y.
APPLICATIONS OF RADIATION EFFECTS IN GLASSES IN LOW- AND HIGH-LEVEL DOSIMETRY
Journal of the American Ceramic Society, Vol. 43, No. 8, 1 August 1960, pp 426-29
(Accession No. 12421)

Two types of dosimetry using special glasses as sensing elements are reviewed. Both systems give an integrated total dose measurement. One system is based on a change in luminescence with dose and covers the range 10 to 10,000 rads. The second system is based on an optical absorption change with dose and covers the range 10^4 to 10^7 rads.

I. A. Bochvar, A. A. Vasil'eva, I. B. Keirim-Markus, I. I. Prosina, Z. M. Syritskaya, and V. V. Yakubik
A DOSIMETER OF IONIZING RADIATION BASED ON MEASURING THE THERMOLUMINESCENCE OF AN ALUMINUM PHOSPHATE GLASS (AN IKC DOSIMETER)
At. Energ. (USSR), 15: 48-52 (July 1963) (In Russian)
(Accession No. 22235)

The following glasses were used to convert ionizing radiation to stored light energy, which is emitted on heating the glass and can be measured by a photomultiplying tube: 5^{0-26}--$MgO \cdot P_2O_5$--$Al_2O_3 \cdot 3P_2O_5$; 34^{0-3}--$SrO \cdot P_2O_5$--$Al_2O_3 \cdot 3P_2O_5$; 2^{0-3}--$Li_2O \cdot P_2O_5$--$Al_2O_3 \cdot 3P_2O_5$; and 58^{0-2}--$SrO \cdot P_2O_5$--$SiO_2 \cdot P_2O_5$--$2(Al_2O_3 \cdot 3P_2O_5)$. The light yield from the glass is 2 to 5% and does not depend on the dose rate of Co^{60} γ rays up to 25 r/sec, or of 500-Mev protons up to 400 r/sec.

E. A. Boettner and L. J. Miedler (University of Michigan, Ann Arbor)
TRANSMITTANCE CHANGES IN GLASSES INDUCED BY ULTRAVIOLET IRRADIATION
J. Opt. Soc. Am. 51, 1310-11 (1961)
(Accession No. 20024)

A plate of Schott KG-2 glass was exposed to radiation from a 100-w. high-pressure Xe lamp for 60-150 min. Transmittance at 3100 A. decreased by 40%. The photochemical reaction involved is caused by radiation with wavelength $\lesssim$ 2800 A.

Arthur Bradley, Radiation Res. Corp., Westbury, Long Island, N.Y.
INSULATION FOR A RADIATION ENVIRONMENT: PART I. INORGANICS
Insulation, 7, (11), Oct. 1961, pp 23-31
(Accession No. 15473)

Of those materials tested, the lowest induced conductivities in the range of 10^4 to 10^5 rads/hr were Corning 1723 glass, natural mica, and synthetic mica crystal which had been irradiated to at least 6 X 10^9 rads. All these had σ between 10^{-17} and 10^{-16} mho/cm at this level of beta excitation. The same materials were also found to be in good condition after 10^{11} rads, and relatively insensitive to the effects of humidity and temperature.

P. J. Bray and A. O. Williams, Jr.
RADIATION DAMAGE STUDIES USING THE TECHNIQUES OF ELECTRON-SPIN PARAMAGNETIC RESONANCE
Brown University, Providence, R. I., TID-5644, 1 March 1960, Annual Prog. Rpt., 1 May 1959-30 April 1960, AT(30-1)2024
(Accession No. 12479)

Glasses under investigation were pure B_2O_3, B_2O_3 containing Na_2O, Corning 7070, Vycor, Nonex, Pyrex, and Corning silica. Absorption lines from gamma, proton, and neutron irradiation were studied.

S. M. Brekhovskikh
RESISTANCE OF INDUSTRIAL GLASS AGAINST THE EFFECT OF GAMMA RAYS
Steklo i Keramika No. 1, 10-14(1958). (In Russian)
(Accession No. 7719)

The light transparency of the glasses was determined before and after irradiation. The color characteristic of the glasses was also determined. The results obtained are tabulated.

S. M. Brekhovskikh
COLOUR AND TRANSPARENCY CHANGES IN GLASSES UNDER ACTION OF Co-60 AND NUCLEAR REACTOR RADIATION
Atomnaya Energie, Vol. 8, January 1960, pp 37-43
(Accession No. 12492)

Nineteen glasses of various oxide compositions were irradiated with 10^6 r from a Co-60 source and 5×10^{10} r in a reactor. The specimens were analyzed with a quartz spectrophotometer (SF-4) and a tri-colored colorimeter (VEI). Their stability, saturation, minimum transparency, and darkening are tabulated, and means for improving radiation resistance are suggested.

S. M. Brekhovskikh
RESISTANCE OF INDUSTRIAL GLASSES TO THE ACTION OF RADIATION
Structure Glass, Proc. All-Union Conf. Glassy State, 3rd, Leningrad, 1959, 314-18 (Pub. 1960) (English translation)
(Accession No. 16078)

The resistance to the action of γ radiation was studied for 18 different glasses. The glass specimens were subjected to doses of 10^2-10^6 r. from a Co^{60} source. From the light transmission of the glasses before and after radiation, it was found that glasses colored with Se, CdS, Co oxide, Cu oxide, dichromate, and S retain their color characteristics virtually unchanged. Other glasses, such as ordinary lime-soda and Mg aluminate glasses, became darker after irradiation with doses greater than 10^4 r.

S. M. Brekhovskikh and Yu. L. Grinshtein
THE EFFECT OF γ-RADIATION ON THE MELTING OF GLASS
Steklo i Keram, 20 (4), 9-10(1963)
(Accession No. 21834)

The effect of γ-radiation on the kinetics of melting glass of the following compounds is studied: SiO_2 71.3, Na_2O 15.5, CaO 7, MgO 4.3, Al_2O_3 2.04 wt. %. γ-Rays affect only those processes occurring in the 1st stages of melting as a possible result of hastening the thermal dissociation of the carbonates.

S. M. Brekhovskikh and E. Z. Zhitomirskaya
RADIATION RESISTANCE OF FOAMED GLASS
Steklo i Keram., No. 5, 16-17 (May 1963)
(Accession No. 22147)

The first type was prepared from 90 to 95% alkali window glass (71.5% SiO_2, 1 to 1.5% Al_2O_3, 7.5 to 8% CaO, 3 to 3.5% MgO, 15% Na_2O) and 10 to 5% Al_2O_3, TiO_2, or ZrO_2, with the addition of 0.5 to 1% SiC or carbon black, or 4% MnO as foaming agents. The second type was prepared from 70 to 80% nonalkali barium glass (60.5% SiO_2, 14.6% Al_2O_3, 16.2% CaO, 8.7% BaO, +2% Fe) and 30 to 20% Cr_2O_3 or ZrO_2, with the addition of 0.5 to 1% SiC or carbon black. The glasses were irradiated with thermal neutrons for 84 hr (total flux about 10^{18} neutrons/cm^2 and subjected to compression tests. Mechanical strength of the specimens remained almost unchanged. It was concluded that foamed glasses from alkali window glass and TiO_2 or ZrO_2 and from nonalkali Ba glass with Cr_2O_3 or ZrO_2 are resistant to radiation and can be used as heat-resistant thermal insulation in equipment exposed to gamma-neutron radiation.

S. M. Brekhovskikh, I. V. Vereshchinskii, A. D. Grishina, S. A. Zelentsov, A. A. Revina, and I. D. Tykachinskii
ELECTRON PARAMAGNETIC RESONANCE (EPR) IN IRRADIATED GLASSES OF DIFFERENT COMPOSITIONS
Tr. 2-go (Vtorogo) Vses. Soveshch. po Radiats, Khim., Akad. Nauk SSSR, Otd. Khim. Nauk, Moscow 1960, 660-7(Pub. 1962)
(Accession No. 21903)

Investigation was made to find glasses with a low EPR signal response on irradiation for use in laboratory investigations by EPR of free radicals and paramagnetic centers resulting from irradiation of substances. These investigations perfectly clarified the effect of some oxides on the EPR spectra of irradiated glasses.

V. Garion-Canina and M. Prilequer, Compagnie de Saint Gobain, Paris
DIFFUSION OF PROTONS IN SiO_2 + Al_2O_3 GLASS IN AN ELECTRICAL FIELD
1962 Conference Radiation Effects on Glass, Rochester, N. Y., 10 pp
(Accession No. 17400)

Experiments have been conducted on two types of silica glass. (1) Vitreous silica, (2) Vitreous silica in which an aluminum impurity has been introduced. Silica 1 was not colored by X rays irradiation. Silica 2 turned brown-violet under X ray irradiation; the color intensity depended upon the aluminum concentration and probably its position and environment in the SiO_2 network.

Herbert G. Chandler
EFFECTS OF PULSED NUCLEAR RADIATION ON NONOPERATING TUBES AND TRANSISTORS
Diamond Ordnance Ruze Laboratories, Dept. of the Army, TR-795, 20 Nov. 1959, DA-506-01-001, ORD Proj. TN3-9101, DOFL Proj. 90293
Available: ASTIA, OTS
(Accession No. 11171)

During Operation Hardtack, electron tubes of both ceramic and glass construction and transistors were exposed to nuclear radiation while they were not functioning. These components were subjected to neutron bombardment as great as 4×10^{14} Pu^{239}nvt. Electrical characteristics of commercially available glass tubes, and of experimental or developmental ceramic tubes, exposed in these tests were measured before radiation and four months after radiation.

J. A. R. Cloutier (Dept. Natl. Health and Welfare, Ottawa)
ROOM-TEMPERATURE STABILIZATION OF RADIATION-PRODUCED FREE RADICALS IN BARBITURIC ACID
Can. J. Phys. 39, 514-33 (1961)
(Accession No. 16442)

Experimental evidence is presented that a boric acid glass can be used at room temperature to stabilize organic free radicals produced by radiation in a number of barbituric acid derivs.

H. C. Colley
A REPORT OF THE IN-PILE TESTING OF SIX CORNING GLASS CAPACITORS
General Electric Co., Aircraft Nuclear Propulsion Dept., XCI-43, 3 August 1959
(Accession No. 12880)

The Radiation Testing Unit of the Applied Materials Sub-Section has conducted a test in the Graphite Reactor of Oak Ridge National Laboratory to determine the effects of radiation on six Corning Glass Capacitors operating at 300°C. At completion of the test five capacitors were considered operational, showing only small changes in capacitance and insulation resistance. One capacitor (#2) failed during the test, shorting out at a dosage of $\sim 9.7 \times 10^{17}$ NVT.

M. Comstock and P. Ferrigno
EFFECTS OF RADIATION ON GLASS--Bibliography
Brookhaven National Lab., Upton, N. Y., TID-17180, BNL-6513, 1962, AT (30-2)-GEN-16, 50 pp
(Accession No. 24005)

A review article convering all types of radiation on all types of glass.

William C. Cooley and Robert J. Janda
HANDBOOK OF SPACE-RADIATION EFFECTS ON SOLAR-CELL POWER SYSTEMS
Exotech, Inc., Alexandriz, Va., NASA-SP-3003, 1963, 107 pp
Available: OTS, NASA
(Accession No. 21159)

W. H. Cropper
RADIATION-INDUCED COLORATION IN GLASS
Sandia Corp., SCR-79, Aug. 1959, Reprint
Available: ASTIA, AD 220599
(Accession No. 10998)

General aspects of radiation-induced coloration in glass are discussed.

D. R. Doman
GAMMA IRRADIATION EFFECTS ON CANDIDATE ELECTRONIC, LIGHTING, OPTICAL, INSTRUMENT, AND STRUCTURAL COMPONENTS FOR IN-REACTOR MONITORING EQUIPMENT
General Electric Co., Hanford Atomic Products Operation, Richland, Wash., HW-76263, Jan. 23, 1963, AT(45-1)-1350, 60pp
Available: OTS, NASA
(Accession No. 22628)

This report gives the results of tests and literature searches made to determine the effects of intense gamma irradiation on materials and components applicable to reactor pressure tube monitoring equipment. Samples of various types of regular and "radiation-protected" glasses and possible optical materials were obtained and tested to 5×10^9 r.

V. S. Elıseev
THE BREMSSTRAHLUMG OF β PARTICLES AND ITS SHIELDING
At. Energ. (USSR), 14: 405-7(Apr. 1963) (In Russian)
(Accession No. 22173)

Experiments were carried out for determining the effect of the Plexiglass, Al, glass, and similar shielding material on the energy of the maximum yield of the bremsstrahlumg in the 0- to 200-kev range, using NaI(T1) scintillation crystals and a photomultiplier, together with a 5-microcurie Sr^{90}-Y^{90} β source.

F. M. Ernsberger and T. E. McGary (Pittsburgh Plate Glass Co., Harmar Township, Penna.)
GAMMA-RADIATION-INDUCED CONDUCTIVITY IN NUCLEAR SHIELDING GLASSES AS DETERMINED BY SPACE CHARGE DECAY
Proc. Conf. Hot Lab. Equip., 11th, New York, 1963, 383-93(1963)
(Accession No. 25056)

Nuclear shielding glasses are shown to acquire a significant degree of transient electrical conductivity during gamma irradiation. An approximate measurement of the effect was made by observing the gamma-induced decay of a space charge placed in the glass by means of an electron accelerator.

N. A. Fedotov
THE EFFECTS OF γ-RAYS ON THE ELECTRODE BEHAVIOUR OF LITHIUM GLASS
Atomnaya Energie, Vol. 8, March 1960, pp. 262-4 (Abstract)
(Accession No. 12500)

The effects of γ radiation on the properties of lithium-glass electrodes were investigated using a 12-mm tube with 27% Li_2O, 3% Cs_2O, and 67% SiO_2. The data indicate that even under intense γ radiation the sensitivity gradient and resistance (within 0.5 to 1.0%) remain constant while their mean absolute potential variation is 3 mv.

R. Fishcer
LUMINESCENCE OF QUARTZ AND QUARTZ GLASS PRODUCED BY γ-RADIATION
Silikat Tech., 11: 453-4(Oct. 1960)
(Accession No. 19840)

Fragments of rock crystal and optical quartz glasses were cut and ground to 20 x 20 x 4 disks and irradiated with Co^{60} γ rays at a dose rate of 2×10^3 r. The luminescence produced by γ radiation is of long duration and accompanied by a brown discoloration similar to that of smoked quartz. A detailed study of the photographic pictures revealed certain inhomogeneities which were greater in quartz glass than in quartz mineral.

William Fulkerson and Thomas W. Leland, Jr., Rice University, Houston, Texas
CATALYTIC ACTIVATION OF VYCOR GLASS FOR THE H_2-D_2 EXCHANGE REACTION BY BETA IRRADIATION
Journal of Catalysis, 2, (2), April, 1963, pp 87-92
Available: NASA, N63-21978
(Accession No. 23585)

The catalytic activity of Vycor glass tubes for the H_2-D_2 exchange reaction was found to be considerably increased by irradiation of the glass with beta radiation. The activation energy for the reaction on Vycor was not changed appreciably by beta irradiation.

G. Gigas, N. M. Ewbank, and D. E. Gruber
INTERIM REPORT ON THE APOLLO WINDOW MATERIALS RADIATION RESTING PROGRAM
North American Aviation, Inc., Atomics International, Canoga Park, Calif., AI-MEMO-9366, Feb 5, 1964, Interim Report, 142 pp
(Accession No. 24319)

Substances proposed as window materials for the Appollo Space Craft were tested for radiation-induced changes in their functional properties. Reported herein are the experimental techniques and apparatus for tests on alumino-silicate glass, chemically hardened glass, fused silica, and medium grade quartz. Four radiator sources were employed: A. Atomics International 2 Mev Electron Statitron, B. University of Southern California 30-Mev Linear Proton Accelerator, C. Atomics International 400 Kev Positive Ion Van de Graaff, D. Harvard University 160 Mev Proton Synchrocyclotron.

Robert Joseph Ginther
RADIATION SENSITIVE GLASS
U. S. Patent 3,097,172, July 9, 1963
(Accession No. 22172)

Incorporation of trivalent cerium into certain lithium-aluminosilicate glasses produces glasses that scintillate in response to gamma rays and neutrons. Li_2O, Al_2O_3, Ce_2O_3, and SiO_2 are used in specified compositions to give pulse heights of 4 to 14% of the pulse height of a NaI(Tl) crystal.

R. J. Ginther and J. H. Schulman, U. S. Naval Research Lab., Washington, D.C.
NEW GLASS DOSIMETER IS LESS ENERGY-DEPENDENT
Nucleonics, Vol. 18, No. 4, April 1960, pp 92, 95
(Accession No. 11652)

A newly developed radiophotoluminescent Mg-Li-Al-Ag phosphate glass has a sensitivity to low-energy gamma rays. The lithium is also expected to provide an enhanced thermal neutron sensitivity over that of the older glass.

Robert C. Good, Jr.
STRUCTURAL RESPONSE TO INTENSE ELECTROMAGNETIC RADIATION (AFOSR-2483)
General Electric Co. Missile and Space Vehicle Dept., Philadelphia, First Annual Technical Report, March 1, 1961 to February 28, 1962, Contract AF 49(638)-1030, 66 pp
(Accession No. 20355)

An Exploding Wire Facility was used as the source of electro-magnetic radiation. Power levels of 10^7 watts were deposited in the wire and the radiation pulse was focused on small specimens of selected materials through reflection in an ellipsoidal mirror. For glass samples, the surface crazed to 10^{-3} cm. Photo-micrographs and profilometer measurements of the surface are pr.

Charles H. Greene, Glass Technology Department, New York State Ceramic College at Alfred University
THE RELEASE OF STRAIN IN PRINCE RUPERT'S DROPS BY GAMMA IRRADIATION
Preprint 45, Session 5, Nuclear Engineering and Science Conference, March 17-21, 1958, at Chicago
(Accession No. 6786)

The present paper describes some qualitative experiments which indicate that tempering does, in fact, have an influence on the rate of color development under gamma irradiation and that a slight amount of release of strain takes place after a heavy dose of irradiation.

J. R. Grover and B. E. Chidley, U.K.A.E.A. Research Group, A.E.R.E., England
GLASSES SUITABLE FOR THE LONG-TERM STORAGE OF FISSION PRODUCTS
Reactor Science and Technology, 16, (8), Aug., 1962, pp 405-421
(Accession No. 18253)

Glass compositions have been examined which are suitable for the incorporation of the highly active wastes from the processing of both uranium-aluminium alloy fuels and natural uranium fuels with a low burn-up. Theoretical prediction of the

effect of composition variables on the melting point and leach resistance has been confirmed experimentally. Samples of glass have been irradiated to a dose of 10^9 rad without any deterioration of leach resistance.

Denver Hale
INVESTIGATION OF A NEW DYE-GLASS GAMMA RADIATION DOSIMETER
Wright Air Development Center, Materials Laboratory, WPAFB, Ohio, WADC-TN-59-79, Tech. Note, May 1957-Jan. 1958, Project No. 7360
Available: ASTIA, AD 214763
(Accession No. 10146)

This is a preliminary report on the investigation of the effects of gamma radiation on a non-aqueous system consisting of organic dyes dispersed in a thin porous glass matrix. This glass, called "thirsty glass" was made by Corning Glass Works (Code 7930). Some physical constants of the glass are: Apparent density (dry)-1.45, Void Space-28% of volume, Average pore diameter-4 m, Developed surface area-200 square meters/gram, Color-Slightly opalescent. The irradiations were conducted in a 1500 curie cobalt 60 source, at a dose rate of 2.8×10^7 erg $g^{-1}hr^{-1}(C)$.

Fred C. Hardtke, Argonne National Lab., Argonne, Ill.
THERMOELECTRICITY IN IRRADIATED GLASS
1962 Conference Radiation Effects on Glass, Rochester, N. Y., Summary Paper No. 10, 8 pp
(Accession No. 17406)

Cabal[3] type glasses were irradiated at room temperature with Cobalt-60. It is possible that Compton electrons emitted from the sample's surroundings, most likely the alumirum jacket of the Cobalt-60 source, penetrate the glass samples and produce the observed thermoelectric effect. Irradiations with 1 Mev van de Graaff electrons produce similar charge displacements, but as much lower doses.

F. C. Hardtke, Argonne National Lab., Argonne, Ill.
NEUTRON SHIELDING CALCULATIONS FOR CURRENT WINDOW DESIGNS
Proc. Conf. Hot Lab. Equip., 9th Chicago 1961, 351-62.
(Accession No. 20002)

Several window designs were compared to heavy concrete in their n and γ-ray shielding effectiveness. Calculations for 2 common designs, glass-$ZnBr_2$ and glass-oil, give biological dose rates for fission n sources within an order of magnitude higher than that of magnetite concrete.

F. C. Hardtke and K. R. Ferguson, Argonne National Lab., Ill.
THE FRACTURE BY ELECTRICAL DISCHARGE OF GAMMA IRRADIATED SHIELDED WINDOW GLASS
Proc. Conf. Hot Lab. Equip., 11th, New York, 1963, 369-81(1963)
(Accession No. 25061)

All glasses tested were easily discharged by an impact probe after an exposure of 1 to 10 megaroentgens. Recommendations are made concerning the design of windows to reduce their susceptibility to fracture.

W. A. Hedden, J. F. Kircher, and B. W. King, Battelle Memorial Inst., Columbus, Ohio
INVESTIGATION OF SOME GLASSES FOR HIGH-LEVEL GAMMA-RADIATION DOSIMETERS
Journal of the American Ceramic Society, Vol, 43, No. 8, 1 August 1960, pp 413-415
Contract No. AF 33(616)-3905, Project No. 7360
(Accession No. 12417)

Several glass systems were evaluated as dosimeters to measure integrated doses in the range from 10^6 to 10^9 rads by measuring optical density as a function of radiation dose. The two more promising glasses of those studied were Corning's Code 8302 and a special high-antimony glass.

J. Raymond Hensler, Norbert J. Kreidl, and Eberhardt Lell
IRRADIATION DAMAGE TO GLASS
Bausch and Lomb, Inc., TID-11034, November 1960, AT (30-1)-1312, 46 pp
(Accession No. 15192)

The development of the following glasses protected against radiation darkening has been completed in the past year: 720293P, 621362P, 673322P, R-2P (Red Filter Glass). The development of the following"protected" glasses is underway: 611588P, 670472P, 573568P, Y-10P (Yello Filter Glass).

A. N. Holdern, E. W. Hoyt, S. V. Cummings, and D. L. Zimmerman, General Electric Co., Pleasanton, Calif.
RADIATION DAMAGE TO BORON-CONTAINING CONTROL MATERIALS
"Properties of Reactor Materials and the Effects of Radiation Damage." London, Butterworths, 1962, pp 457-74
(Accession No. 19863)

Data include physical property damage, damage due to helium and the extent of helium release, dimensional changes, and x-ray metallographic examination of the damage. General discussion on the fundamentals of damage to boron materials including boron glass is given.

W. Jahn, Glaswerks Schoot & Gen., Jenaer, Manz, Germany
THE ABSORPTIVE PROPERTIES OF RADIATION PROTECTION GLASS
Atompraxis, Vol. 6, 1960, pp 82-7
(Accession No. 12501)

Irradiation processes in hot cells can be directly observed with the aid of radiation-absorbing glasses. On account of undesirable changes which may appear in the glasses as a result of γ radiation, an exact determination of the extent of discoloration is such glasses is necessary. In addition, a large number of other characteristics must be known, e.g. natural color, reflection, the absorption coefficient in regard to γ radiation, and build-up factors. These data were determined by irradiation experiments, measurements, and calculations. They are given in the form of graphs and tables.

Alex E. Javitz, Special Features Editor
RESEARH PROGRESS IN DIELECTRICES - 1959
Electrical Manufacturing, Vol. 65, No. 1, Jan. 1960, pp 60-70
(Accession No. 11163)

Samples of boron nitride, quartz, mica compositions, polystyrene, and glass were irradiated in an electron beam. Induced conductivity measurements were then carried out under 10^4 rads/hr of krypton-85 beta radiation using a special irradiation cell. It was found that natural mica and Corning 1723 glass had the lowest induced conductivities of the materials tested.

E. R. Johnson
UNCLASSIFIED LITERATURE SURVEY ON THE EFFECTS OF NUCLEAR RADIATION TO ELECTRON TUBE MATERIALS
Stevens Institute of Technology, Qtly. Rpt. for 31 May-1 Sept. 1958, DA-36-039-SC-73146 (Accession No. 8755)

The purpose of this report is to make a review of the classified and unclassified literature on the effect of nuclear radiation on electron tube materials. In addition experimental work to determine the threshold for radiation damage to glass used in electron tube manufacture is reported.

E. R. Johnson
UNCLASSIFIED LITERATURE SURVEY ON THE EFFECTS OF NUCLEAR RADIATION TO ELECTRON TUBE MATERIALS
Stevens Institute of Technology, Qtly. Rpt. for 1 Sept.-30 Nov. 1958, DA-36-039-SC-73146 (Accession No. 8809)

E. R. Johnson
UNCLASSIFIED LITERATURE SUVERY ON THE EFFECTS OF NUCLEAR RADIATION TO ELECTRON TUBE MATERIALS
Stevens Institute of Technology, Hoboken, N. J., 7th Qtly. Rpt., 1 Dec. 1958-28 Feb. 1959, DA-36-039-SC-73146
(Accession No. 9546)

E. R. Johnson
UNCLASSIFIED LITERATURE SURVEY ON THE EFFECTS OF NUCLEAR RADIATION TO ELECTRON TUBE MATERIAL
Stevens Institute of Technology, Hoboken, N. J., Qtly. Rpt. #11, 1 Dec. 1959-29 Feb. 1960, DA-36-039-SC-73146
Available: ASTIA
(Accession No. 11891)

E. R. Johnson
UNCLASSIFIED LITERATURE SURVEY ON EFFECTS OF NUCLEAR RADIATION TO ELECTRON TUBE MATERIALS
Stevens Institute of Technology, Dept. of Chemistry and Chemical Engineering, Hoboken, N. J., Qtly. Rpt. No. 14, 1 Sept. - 31 Oct. 1960, DA-36-039-SC-73146, 41 pp
Available: ASTIA
(Accession No. 13311)

E. R. Johnson
UNCLASSIFIED LITERATURE SURVEY ON EFFECTS OF NUCLEAR RADIATION TO ELECTRON TUBE MATERIALS
Stevens Institute of Technology, Dept. of Chemistry and Chemical Engineering, Hoboken, N. J., Final Rpt., 1 Feb. 1957-31 Oct. 1960, DA-36-039-SC-73146
Available: ASTIA
(Accession No. 13988)

John W. Kallander, U. S. Naval Research Laboratory, Washington, D.C.
POST IRRADIATION THERMAL AND ELECTRICAL PROPERTIES OF MAGNET WIRE INSULATION
Paper presented at the AIEE Winter General Meeting, N. Y., N. Y., 31 Jan.-5 Feb. 1960, AIEE-60-89
(Accession No. 11207)

The effects of gamma irradiation on the thermal aging lives and the electric strengths of a wide range of magnet wire insulations including glass have been determined.

E. E. Kerlin and E. T. Smith
MEASURED EFFECTS OF THE VARIOUS COMBINATIONS OF NUCLEAR RADIATION, VACUUM, AND CRYOTEMPERATURES ON ENGINEERING MATERIALS
General Dynamics/Fort Worth, Nuclear Aerospace Research Facility, Fort Worth, Tex., FZK-167, June 28, 1963, Qtly. Prog. Rpt., March 1 - May 31, 1963, NAS8-2450, 77 pp
(Accession No. 22949)

Irradiations were conducted to an exposure of 5×10^{10} ergs/gm (C). Tests on Milimene glass 6038 after irradiation in air and in LN_2 revealed that it is virtually unaffected by either the low or high doses of radiation.

W. L. Kinney, E. R. Schumann, P. A. Weiss
HYDRAULIC SERVO CONTROL VALVES, RESEARCH ON ELECTROHYDRAULIC SERVO VALVES DEALING WITH OIL CONTAMINATION, LIFE AND RELIABILITY, NUCLEAR RADIATION AND VALVE TESTING
Cook Electric Co., Morton Grove, Ill., WADC-TR-55-29, Pt. 6, November 1958, AF 33(616)-5136
Available: ASTIA, AD 211733
(Accession No. 10110)

EFFECTS OF NUCLEAR RADIATION ON ELECTROHYDRAULIC SERVO VALVES AND ASSOCIATED CONTROL COMPONENTS

It was the purpose of this task to investigate the problems associated with operating electrohydraulic servo valves and associated equipment in a nuclear environment and to test a suitable unit under gamma radiation at the temperature range between 400° to 1000°F. Among insulation found suitable for the present study were aluminum oxide and magnesium oxide, polyethylene, and glass without boron.

J. F. Kircher, B. W. King, M. J. Oestmann, P. Schall and G. D. Calkins, Battelle Memorial Institute, Columbus, Ohio
RECENT RESEARCH IN HIGH-LEVEL GAMMA DOSIMETRY
Paper presented at the 2nd United Nations International Conference on the Peaceful Uses of Atomic Energy, Geneva, Switzerland, 15/P/2001, 1-13 September 1958
(Accession No. 7797)

The irradiations of the various dosimeter samples were carried out in the Battelle 3000-curie cobalt-60 facility. In preparing experimental glasses, particular attention was given to antimonate glasses since they contain a large portion of polyvalent oxide and are known to take on a rather permanent radiation-induced color. Optical-density measurements were made with a Beckman DU spectrophotometer at selected wavelengths. The coloration induced by irradiation is reported in terms of the change in the extinction coefficient of the glasses. According to data published by C. Mannal on the effect of gamma radiation on the optical density of Code 8392 glass, made by Corning Glass Works, it appeared that this glass might be satisfactory for a dosimeter.

W. P. Knox
Appendix E - EFFECTS OF COBALT 60 GAMMA RAYS ON LOW-MELTING, GLASS-COATED SILICON DIODES
Bell Telephone Laboratories, Inc., Whippany, N. J., ASD-TDR-62-189, Nov. 15, 1961, Eighth Triannual Tech. Note, July 1 - Oct. 31, 1961, AF 33(616)-6232, 101 pp
Available: ASTIA
(Accession No. 16704)

An irradiation was performed at the Brookhaven National Laboratories gamma facility to determine the effect of 9.4×10^7 roentgen gamma rays on several 56-volt experimental silicon diodes coated with different types of low-melting glass systems. The following measurements were made concurrent with gamma irradiation. 1. diode reverse current, 2. forward voltage current characteristic, 3. reverse voltage current characteristic. It was concluded that there was no significant permanent damage to the devices due to the above gamma dose.

W. P. Knox
Appendix C - EFFECTS OF FAST NEUTRONS AND GAMMA RAYS ON LOW MELTING-TEMPERATURE, GLASS-COATED SILICON DIODES
Bell Telephone Labs., Inc., Whippany, N. J., ASD-TDR-62-1101, Oct. 31, 1962, Eleventh Triannual Tech. Note, July 1 - Oct. 31, 1962, AF 33(616)-6235, pp 59-91
Available: ASTIA
(Accession No. 19079)

Based on the results of data obtained from a series of gamma and neutron irradiations, no significant variations in behavior could be detected in any of the measured parameters for the different glass coatings as compared to the vacuum-encapsulated diode used as a control in this experiment.

Norbert J. Kreidl, Harold C. Hafner, Joseph R. Hensler, and Robert A. Weidel
INVESTIGATION OF INFRARED TRANSMITTING MATERIALS
Bausch and Lomb Optical Co., WADC-TR-55-500, Part 3, Oct. 1958, Jan. 1957 - Jan. 1958, AF 33(616)2769, p 16
Available: ASTIA, AD 202842
(Accession No. 9542)

Samples of both 1A5974 and 1A6051 type calcium aluminate glass were exposed to 1.2×10^6 rep and 1×10^7 rep in a Co^{60} source. The change in transmission is not large in either sample and significance of the observed increase or decrease in transmission might be questioned. However, the decrease in transmission of the 1A5974 sample both in the visible and in the infrared out to 2.75μ appears great enough to be real, while the increase in transmission of the 1A6051 sample between 2.90μ and 5.25μ, also is large enough to appear real.

Norbert J. Kreidl and Gerald E. Blair, Bausch and Lomb Optical Company
GLASS DOSIMETRY
Nucleonics, Vol. 17, No. 10, Oct. 1959, p 58
(Accession No. 10510)

The advantages of glass as a dosimetry material include ruggedness, shelf-life stability, stability of radiation-induced changes, reproducibility, low cost and capability of being manufactured in practically unlimited size and shape. Existing systems are nonabsolute and require calibration against some primary standard, such as a carbon calorimeter. (Ha_458).

Norbert J. Kreidl and J. Raymond Hensler
IRRADIATION DAMAGE TO GLASS
Bausch & Lomb Optical Co., Rochester, N. Y., NYO-2382, Nov. 1959, AT(30-1)1312
(Accession No. 11355)

To allow more flexibility in optical design two optical glasses and one red filter glass were added to the series of glasses developed to be used under high intensity radiation conditions. The transmission curves for these glasses before and after exposure are given in Appendix IV. The R-2 red filter glass is of interest as the first filter glass to have been developed in the radiation-protected type. The 720:293P flint glass was found satisfactory for certain applications but further development would be considered desirable to improve the degree of protection.

Marc Lefort, Institut du Radium et Laboratoire de Physique Nucleaire de la Faculte des Sciences de Paris, Orsay, France
RADIATION CHEMISTRY
Annual Review of Physical Chemistry, Vol. 9, 1958, pp 123-156
(Accession No. 9822)

A review with 188 references.

E. Lell, Bausch & Lomb Inc., Rochester, N. Y. and R. A. Weeks, Oak Ridge National Lab., Oak Ridge, Tenn.
DIELECTRIC MEASUREMENTS IN SOME IRRADIATED GLASSES
1962 conference Radiation Effects on Glass, Rochester, N. Y., Summary Paper No. 11, 3 pp
(Accession No. 17405)

These studies have been concerned with the effect of electron (1.5 Mev) and γ-ray (Co-60) irradiation on the dielectric relaxation spectrum, and the intrinsic electrical conductivity of high purity silica, lead silicate glass, phosphate glass, and Pyrex.

E. Lell, Bausch & Lomb, Inc., Rochester, New York, and R. A. Weeks, Union Carbide Corp., ORNL, Oak Ridge, Tenn.
EFFECTS OF IRRADIATION ON POLARIZATION CURRENTS IN A LEAD SILICATE GLASS
Bulletin of the American Physical Society, Series II, 8, (4), April, 1963, pp 340
(Accession No. 19311)

The dc conductivity of a lead silicate glass was measured as a function of voltage, specimen-thickness temperature, and irradiation with Cobalt-60 γ-rays.

P. A. Lockwood
INVESTIGATIONS OF RADIOACTIVE FUEL-BEARING GLASSES
Owens-Corning Fiberglas Corp., Granville, O., NYO-9736, June 30, 1962, AEC Research and Development Rpt., April 1, 1961 - March 31, 1962, AT-(30-1)-2489, 43 pp
(Accession No. 18058)

A series of high urania-content glasses were fiberized and examined for high temperature strength properties.

Thomas E. Lusk, General Electric Co., Ithaca, N.Y.
INFRARED-TRANSMISSION MATERIALS WOULD BE UNAFFECTED BY RADIATION IN SPACE
Electronic Design, 26 Oct. 1960
(Accession No. 14633)

The infrared transmission properties of the 15 materials were tested after exposure to three levels of gamma radiation.

J. V. Malek
RESEARCH ON R.F. COAXIAL CONNECTORS, BROADBAND, HIGH TEMPERATURE, RADIATION RESISTANT
Amphenol-Borg Electronics Corp., Amphenol Connector Div., Chicago, Ill., Dec. 1959, Scientific Rpt. #3, 1 Sept.-1 Dec. 1959, AF 33(616)6243
(Accession No. 11385)

A paper concerned with measurements of the induced conductivity generated in materials by radiation.

P. W. McMillan and B. P. Hodgson, Nelson Research Laboratories, English Electric Company Ltd., Stafford
NEUTRON-ABSORBING GLASS-CERAMICS
Glass Technology, 5, (4), August 1964, pp 142-149
(Accession No. 25651)

Glasses based on the systems $CdO-In_2O_3-SiO_2$ and $CdO-In_2O_3-B_2O_3$ were investigated. These glasses have high neutron absorptions but are not sufficiently refractory for for certain control rod applications. It was found, however, that the controlled crystallisation of the glasses gave microcrystalline glass-ceramics with improved properties, while retaining the high neutron absorption of the parent glasses.

T. M. Mike, B. L. Steierman, and Ed. F. Degering, Owen-Illinois, Toledo, Ohio
EFFECTS OF ELECTRON BOMBARDMENT ON PROPERTIES OF VARIOUS GLASSES
Journal of the American Ceramic Society, Vol. 43, No. 8, 1 Aug. 1960, pp 405-407
(Accession No. 12415)

Glass rods of three commercial types were obtained: borosilicate, soda-lime, and lead glass. The irradiation was performed with 2 m.e.v. electrons from a Van de Graaff generator. Groups of rods were exposed to dosages of 1, 3, 10, 30, 100, and 300 megareps.

John L. Patterson and William E. Miller (Langley Research Center, Hampton, Va.)
ARTIFICIAL ELECTRON-BELT RADIATION PROTECTION FOR THE EXPLORER XVI SOLAR CELL POWER SUPPLY
New York, American Inst. of Aeronautics and Astronautics, 1963, Preprint 63-186, 11 pp, (CONF-97-14)
(Accession No. 22523)

Samples of the solar cells and prospective shielding materials were irradiated with 1.2-Mev electrons from the Langley Research Center electron accelerator in order to determine additional protection needed. It was concluded the 3/16-in. quartz windows will protect the cells sufficiently that service lifetimes greater than one year may be obtained.

J. C. Peden, Editor
SOLAR CELL SHIELD MATERIALS
General Electric Co., Missile & Space Vehicle Dept., Philadelphia, Pa., GE 137-108, 13 May 1961
(Accession No. 14481)

This memo summarizes preliminary results of electron irradiations on various possible solar cell shield materials.

E. R. Pfaff, Program Director
THE EFFECTS OF NUCLEAR RADIATION ON ELECTRONIC COMPONENTS
Admiral Corp., Government Labs. Div., Chicago, Ill., July 1960, Scientific Rpt. #1, AF 33(616)-6033
(Accession No. 12666)

The Corning Glass Company and the Admiral Corporation tested several glass samples in the CP-5 reactor. The changes in density with irradiation are quite evident.

J. Paymal and P. Le Clerc, Direction des Services de Recherches, Saint-Gobain, Paris
STUDY OF THE ELESTIC PROPERTIES OF CERTAIN GLASSES IRRADIATED BY NEUTRONS
1962 Conference Radiation Effects on Glass, Rochester, N. Y., Summary Paper No. 8, 5 pp
(Accession No. 17408)

The subject of this study is the action on certain glasses of charged particles, in this particular case helium and lithium nuclei, produced inside the samples by the effect of neutron flux on boron included for the purpose as an ingredient of the glass.

J. Paymal, M. Bonnaud, and P. Le Clerc, Services de Recherches de la Compagnie de Saint-Gobain, Paris, France
RADIATION DOSIMETER GLASSES
Journal of the American Ceramic Society, Vol. 43, No. 8, 1 August 1960, pp 430-436
(Accession No. 12422)

The addition to the manganese glass of a stabilizing element (such as iron, chromium, or vanadium) having also a coloring effect makes it possible to obtain particularly sensitive and stable dosimeters.

J. Paymal, P. Le Clerc, M. Bonnaud, and S. de Bonnery, Compagnie de Saint-Gobain, Paris
OBSERVATION OF SOME EFFECTS OF (n,γ) REACTIONS IN GLASSES BY MEASUREMENTS OF DENSITIES, DEFORMATIONS AND STRESSES
"Selected Topics in Radiation Dosimetry.", Vienna, International Atomic Energy Agency, 1961, pp 555-66 (In French)
(Accession No. 15814)

The extent of variations in the density of glasses of varying composition, exposed in the same conditions of flux, temperature and duration, shows that glasses rich in silica or in lattice-forming oxides generally undergo an increase in density. On the other hand, some glasses rich in modifying oxides, and particularly glasses containing lead oxide, undergo a decrease in density.

T. M. Proctor, Corning Glass Works, Corning, New York
X-RAY INDUCED ELECTRICAL POLARIZATION IN GLASS
Physical Review, Vol. 116, No. 6, 15 December 1959, pp 1436-1440
(Accession No. 12051)

Electrical polarization in a lead silicate glass induced by the action of x-rays on the material is found to exist. This phenomenon is surveyed experimentally as a function of total dose (incident and absorbed), dose rate, x-rays tube potential, radiation temperature, and temperatures at which the polarization is released and measured.

Francis X. Rizzo, Albert C. Muller, and Martin S. Zucker, Brookhaven National Lab., Upton, N. Y.)
ELECTRICAL DISCHARGE IN GAMMA IRRADIATED LEAD SHIELDING GLASS
Proc. Conf. Hot Lab. Equip., 11th, New York, 1963, 395-412(1963)
(Accession No. 25072)

A mathematical model, describing discharge of shielding glass as a result of gamma irradiation was formulated and experimentally verified to be a good order-of-magnitude approximation. Experimental results indicated an electronic process, associated with storage of electrons in color centers similar to those of cerium, is involved. Studies indicated further that lead in glass may serve to decrease dielectric breakdown strength.

William S. Rothwell
RADIATION SHIELDING WINDOW GLASSES
Corning Glass Works, Research Lab., Corning, N. Y., 25 pp
(Accession No. 17745)

Three glasses were developed by Corning Glass Works for use in radiation shielding windows. Properties which relate to their special use are presented.

Yu. Rotnitski and S. Minta
ALTERATIONS OF PHYSICAL AND CHEMICAL PROPERTIES OF GLASSES UNDER INFLUENCE OF GAMMA-RADIATION. 1. INVESTIGATION OF TRANSPARENCE OF SODA LIME GLASSES TREATED WITH BIG DOSES OF GAMMA-RAYS
Pol'skaia Akademiia Nauk Institut Iadernykh Issledovanii, English Summary, PAN-185/ChR, 3 pp
(Accession No. 15435)

Soda lime glass was treated with big doses of gamma-rays. The alterations of coloration and transparence of the glass under the influence of radiation, so as the relaxation phenomenon when the irradiated patterns have been kept were investigated.

P. S. Rudolph, Oak Ridge National Lab., Tenn.
THE IRRADIATION OF GLASSES
Fusion, 9: 9-16(Feb. 1962)
(Accession No. 19916)

Radiation effects on glass are discussed. The properties of ionizing radiations are described. The changes in the properties of various glasses after irradiation are also described.

Friedrich Schlact, Deut. Akad. Wiss., Berlin
PREPARATION OF SYNTHETIC QUARTZ GLASS BY LABORATORY EXPERIMENTS
Ber. Geol. Ges. Deut. Demokrat. Rep. Gesamtgebiet Geol. Wiss. 7, 533-43 (1962)
(Accession No. 24196)

Samples of synthetic quartz glass, some cm^3, were produced by hydrolysis of $SiCl_4$ in an O--H flame. This material is very pure and contains Cu 3.5, Zn 60, As 1.4, Sb 3.7, P 1600, Fe 4600 (all values x 10^{-7} wt. %), and has no noticeable absorption in the ultraviolet range until down to 180 mm. It is very resistant to x-ray, γ, and neutron radiation.

Irvin P. Seegman, William Cheorvas, Francis H. Ingham, and Paul A. Mallard
DEVELOPMENT OF HIGH TEMPERATURE SEALANTS
Products Research Co., WADD-TR-58-89, Pt. 3, Sept. 1960, Tech. Rpt., 1 Feb. 1959 - 31 July 1960, AF 33(616)-3976
(Accession No. 13474)

Materials which have been used for radiation dosimeter applications were investigated in the hope that they could act as anti-rads by serving as energy sinks for radiation energy. Ferrous sulfate and Corning Code 8392 glass were investigated in this respect.

Yoshihiko Shono, Shigeharu Koshino, Toshio Yoshida, and Takeyoshi Seiyama
ELECTRON SPIN RESONANCE OF GAMMA-IRRADIATED GLASSES
Ann. Rept. Radiation Center Osaka Prefect., 2: 85-6(1961) (In English)
(Accession No. 20916)

Electron spin resonance measurements are reported for gamma-irradiated borosilicate and soda-lime glasses.

Naohiro Soga and Megumi Tashiro, Univ. Kyoto, Japan
ROLE OF CERIUM ION IN PREVENTING THE COLORATION OF GLASS INDUCED BY γ RAYS
Yogyo Kyokai Shi 70, 143-7(1962)
(Accession No. 24194)

Glasses containing various amounts of Ce were exposed to γ rays until colored and then the fading of the color was studied with the lapse of time.

R. Spencer
DEVELOPMENT AND EVALUATION OF ELECTRON TUBE GLASSES RESISTANT TO RADIATION DAMAGE
Tung-Sol Electric, Inc., Chatham Electronics, Livingston, N. J., Final Rpt., 1 May 1959 - 30 September 1960, DA-36-039-SC-78312
Available: ASTIA
(Accession No. 13854)

Dummy bulbs of Corning 0080, 0120, 7720, 1723 and 1715 glass, and dummy bulbs of Owens-Illinois 51-26 (boron-free), 3% and 6% B_2O_3 glass were exposed to various integrated thermal neutron fluxes of from 0.367×10^{16} nvt to 5.77×10^{18} nvt.

Jackson S. Stroud, Corning Glass Works, Corning, N. Y.
ELECTRON AND HOLE TRAPPING IN BINARY CLASSES: OPTICAL STUDIES
1962 Conference Radiation Effects on Glass, Rochester, N. Y., Summary Paper No. 13, 7 pp
(Accession No. 17403)

Those centers which form optical absorption bands have been studied in a glass with the approximate weight per cent composition 75% SiO_2, 25% Na_2O by doping the glass with known concentrations of Ce^{3+} and Ce^{4+} and by observing the optical absorption changes caused by irradiation.

Toshio Sugiura, Keiichi Murakami, and Hirobumi Tanaka
THE INFLUENCE OF γ-IRRADIATION ON THE ELECTRIC CONDUCTIVITY OF GLASSES
Yogyo Kyokai Shi, 70: 28-31(Jan. 1962)
(Accession No. 19904)

The effects of γ radiation on the electric conductivity of glasses and the applicability of the irradiated glasses to semiconductive glass or radiation dosimeters are discussed.

Christiane Susse and Jean Paymal, Lab Hautes Pressions, Paris
EFFECT OF PRESSURE ON THE MODULUS OF RIGIDITY OF TWO BORON GLASSES IRRADIATED BY THERMAL NEUTRONS
Compt. Rend. 253, 792-4(1961)
(Accession No. 16671)

The measurement of the effect of pressure on the coefficient of rigidity (G) of irradiated borosilicate and Pb glasses was studied.

S. I. Taimuty
OBTAINING A SYSTEM OF DOSIMETRY
Stanford Research Institute, Menlo Park, Calif., S-559, Prog. Rpt. #8, 28 Nov. 1957-27 Jan. 1958, DA-19-129-QM-766
Available: ASTIA, AD 205351
(Accession No. 10491)

Only four of the more than twenty systems studied merit consideration for further development and reduction to practice at this time. These are anthracene (photoluminescent degradation), glass (coloration), Fricke (ferrous oxidation), and ceric sulfate (ceric reduction). None of the four candidate systems alone is capable of covering the dose range, 10^4 to 10^7 rads. Consequently, a pair of systems must

be chosen for final development to meet the desired criteria. The candidate pairs of systems from which a choice must be made are anthracene plus glass, ceric sulfate plus glass, and ceric sulfate plus Fricke. Silver-activated phosphate glass is one of the systems studied in the screening program. Calibration curves for this glass are shown. The exposures were performed in the Stanford Research Institute cobalt-60 source at a dose rate of 1.35×10^5 rads/hr.

S. I. Taimuty
A REVIEW OF DOSIMETRY FIELD
Stanford Research Institute, Menlo Park, Calif., S-611, Sept. 10, 1962, Final Rpt. No. 4, Sept. 14, 1961 - Sept. 13, 1962, DA-19-129-QM-1900, 26 pp
Available: DDC, AD 296591
(Accession No. 20984)

This report presents a review and critical evaluation of the literature on high-level gamma and electron beam radiation dosimetry published since 1958. Characteristics of dosimeters are summarized.

Rohn Truell and Constantine Mylonas
RADIATION EFFECTS INVOLVING THE (n,α) REACTION IN GLASS CONTAINING BORON
Brown University, Metals Research Lab., AFOSR-TR-60-160, 1 Oct. 1960, Tech. Rpt., AF 49(638)-450
Available: ASTIA, AD 247031
(Accession No. 13961)

The damage effects produced in glass by the reaction of slow neutrons with boron has been studied in some detail. The damage effects studied were basically volume changes and changes in ultrasonic attenuation and velocity. The volume changes were detected by length measurements on rods and independently through the birefringence induced by non-uniform straining of glass blocks. Thus the present study includes:
I. Changes in physical dimension, a. Contraction of thin glass rods
b. Birefringence of glass blocks
II. Changes in ultrasonic attenuation and velocity
The particular glass used in most of these experiments was Corning 7070 glass with the nominal composition given as: SiO_2 70.2% Li_2O 1.2%
B_2O_3 28.0% K_2O 0.6%

D. G. Tuck, University of Nottingham, England
RADIATION DAMAGE TO GLASS SURFACES BY α-PARTICLE BOMBARDMENT
International Journal of Applied Radiation and Isotopes, 15, 1964, pp 49-57
(Accession No. 22928)

The bombardment of glass surfaces with α-particles from Po^{210}, Rn^{222}, Ra^{226}, Pu^{239}, and Cm^{242} causes surfaces changes both in the presence and absence of an aqueous phase. These changes are discussed.

V. V. Vargin and S. A. Stepanov
THE EFFECT OF γ-RADIATION ON Na_2O--Al_2O_3--SiO_2 GLASSES
Dokl. Akad. Nauk SSSR, 147: 609-11(Nov. 21, 1962) (In Russian)
(Accession No. 19677)

Glasses containing 13 to 40 mol % Na_2O and from 0 to 35 mol % Al_2O_3 were subjected to a total dose of 5 x 10^6 r (in some cases, 3 x 10^7 r), and the absorption spectra before and after irradiation were measured on the spectrophotometer at wavelengths of 210 to 1100 $m\mu$. The difference in optical density before and after irradiation (ΔD) is plotted against the wavelength (λ), expressed in electrovolts.

G. Ya. Vasil'yev, A. F. Usatiy, Yu. S. Lazurkin, and A. A. Markov
MEASUREMENT OF THE LUMINESCENCE AND DARKENING OF GLASS DURING THE PROCESS OF THEIR IRRADIATION IN A NUCLEAR REACTOR (IZMERENIYE LYUMINESTSENTSII I POTEMNENIYA STEKOL V PROTSESSE IKH OBLUCHENIYA V YADERNOM REAKTORE)
Doklady Akademii nauk SSSR, Vol. 125, No. 6, 1959, pp 1219-1222 (USSR)
(Accession No. 10906)

The present paper is intended to work out the construction of a device for the simultaneous measurement of the luminescence and darkening of transparent materials in a nuclear reactor. Measurements were carried out on various types of quartz, pyrex glass, and cerium glass.

B. M. Vul, P. N. Lebedev Physics Institute, Academy of Sciences, Moscow, USSR
THE EFFECT OF GAMMA RADIATION ON THE ELECTRICAL CONDUCTIVITY OF INSULATORS
Soviet Physics - Solid State, 3, (8), Feb., 1962, pp 1644
(Accession No. 16618)

Various materials were subjected to irradiation by radioactive preparations; these included fused quartz, glass, ceramic material-mullite, sulfur, polyethylene, rubber for cable insulation, and others. In all of these materials it was established that, for moderate intensities of the electric field, the excess current caused by the gamma radiation was directly proportional to the applied voltage.

Norman E. Wahl and John V. Robinson
THE EFFECTS OF HIGH VACUUM AND RADIATION ON POLYMERIC MATERIALS
Bell Aerosystems Co., Research Dept., Buffalo, N. Y., Paper presented at the National Symposium on The Effects of Space Environment On Materials, St. Louis, Mo., May 7-9, 1962, 28 pp, Contract AF33(616)-6267
(Accession No. 17337)

The experimental work carried out in this program consisted of two parts. Part one is the evaluation of the effects of ultraviolet radiation, heat and vacuum on: Glass Reinforced laminates, Transparent glazing materials of glass and plastic, White polyurethane coating. Part two is the determination of the effects of gamma radiation and vacuum on: Plastic and elastomeric seals, Pyrex glass.

R. A. Weeks and E. Lell
THE EFFECTS OF HIGH ENERGY RADIATION ON THE POLARIZATION CURRENTS IN SOME GLASSES
Oak Ridge National Lab., Oak Ridge, Tenn., Presented at the Symposium on Dielectrics in Space, Westinghouse Electric Co., Pittsburgh, Pa., June 25-26, 1963, 16 pp
Available: NASA, N63-22693
(Accession No. 23589)

Glasses with a high ($\sim 10^{19}$ ohm-cm) and some with low ($\sim 10^{17}$ ohm-cm) intrinsic resistivity exhibit the discharge effect when irradiated with electrons. Since the discharge effect involves electrical processes, it seemed reasonable to investigate the D.C. electrical properties of the glasses of interest. Interest was directed to a study of the low-frequency and dc conductivity of several glasses. The loss tangent (ac conductivity) of a lead silicate glass is shown as a function of frequency and time after electron irradiation.

G. R. Weinberg
DEVELOPMENT AND EVALUATION OF ELECTRON TUBE GLASSES RESISTANT TO RADIATION DAMAGE
Tung-Sol Electric, Inc., Chatham Electronics, Livingston, N. J., Final Rpt., 1 May 1958-30 April 1959, DA-36-039-SC-75065
(Accession No. 10240)

All glass types are subject to discoloration in varying degrees when exposed to nuclear radiation. The shade of discoloration deepens with increase in flux and increase in wall thickness, and depends also on the composition of the glass. From the tested glass types 0080, 0120, 7052, 7720, 1720, 51-26, 3% B_2O_3 and 6% B_2O_3, only the 7052 glass was not able to withstand an integrated thermal neutron flux of 10^{16} NVT. It is, therefore, believed that a flux of 10^{16} NVT is not sufficient to cause serious damage to most glasses. When the integrated thermal neutron flux was increased to 10^{17} NVT, 7720 glass did not withstand the exposure and all enclosures of this glass type cracked. The damage caused by nuclear radiation may also depend on the initial strain in the glass before exposure to radiation.

G. R. Weinberg
DEVELOPMENT AND EVALUATION OF ELECTRON TUBE GLASSES RESISTANT TO RADIATION DAMAGE
Tung-Sol Electric Inc., Chatham Electronics, Livingston, N. J., 1st Semi-Annual Prog. Rpt., 1 May-1 Nov. 1959, DA-36-039-SC-78312
Available: ASTIA
(Accession No. 11169)

Dummy bulbs, with and without leads, made of Owens-Illinois 51-26 boron-free glass, of 3% B_2O_3 and 6% B_2O_3 glass and Corning 7052 and 1723 glass were exposed to neutron bombardment of integrated thermal flux of 10^{16} NVT. Some of these enclosures were checked for strain before and after exposure and others were analyzed for gas content after exposure.

M. M. Weiss and W. P. Knox
THE EFFECTS OF GAMMA RADIATION ON GLASS COATED SILICON TRANSISTORS
Institute of Electrical and Electronics Engineers 1963 Summer Meeting, Toronto, June 1963, 21 pp (CONF-1-23)
(Accession No. 22481)

The bare devices were dipped in a high purity low melting point glass consisting of 24% AS, 67% S, and 9% I by weight. The results indicate that the glass coating process significantly decreased the magnitude of the increase of reverse collector-base current (I_{CBO}) of the devices so treated when placed in a gamma radiation environment.

M. M. Weiss and W. P. Knox, Bell Telephone Labs., Whippany, N. J.
THE EFFECTS OF GAMMA RADIATION ON GLASS COATED SILICON TRANSISTORS
IEEE Transactions on Nuclear Science, NS-10, (5), Nov., 1963, pp 28-34
(Accession No. 22631)

This paper describes the results of experiments performed to study the effects of exposure to gamma radiation on selected silicon transistors when coated with a low temperature melting glass. The low-melting-point glass consisted of 24% As, 67% S, and 9% I by weight. The glass coating process demonstrated a treatment which materially improves the gamma exposure response of devices so treated.

H. A. Woodbury, H. Eyring, and A. F. Gabrysh, University of Utah, Salt Lake City
THERMOLUMINESCENCE OF GOLDEN SAPPHIRE AND FUSED BORAX SEEDED WITH Ni, Mg, and UO_3
J. Phys. Chem 66, 551-4(1962)
(Accession No. 20044)

The influence of impurities and single-crystal structure on thermoluminescence glow curves for samples irradiated with Co^{60} γ-rays at liquid N temperature was studied. Fused borax glasses containing either Ni, Mg, Ni + Mg, or various weight % UO_3, and single-crystal golden sapphire (Al_2O_3 + Ni + Mg), were used.

Kakuji Yamamoto, Tokyo Metropolitan Isotope Center
INDUCEMENT OF COLOR TO MANGANESE GLASS BY γ-RAY IRRADIATION AND ITS APPLICATION TO DOSIMETRY
Oyo Butsuri, 31: 359-93 (May 1962) (In Japanese)
(Accession No. 22326)

Test results indicated that Mn glass used in dosimetry could maintain sufficient color stability within dosage ranges of 3.5×10^4 to 10^7 r.

Kakuji Yamamoto, Tokyo Metropolitan Isotope Center
DOSIMETRY OF NEUTRONS FROM Ra--Be SOURCE BY OPTICAL GLASS
Oyo Butsuri 31: 338-41 (May 1962) (In Japanese)
(Accession No. 22329)

A simple, small-scale laboratory method to determine the linear relation between the neutron dosage and the γ-induced color shade of glasses is described.

Kakuji Yamamoto, Tokyo Metropolitan Isotope Center
FLUOROGLASS DOSIMETER AND ITS STANDARDIZATION
Oyo Butsuri, 32: 421-9 (June 1963) (In Japanese)
(Accession No. 24134)

The properties of a fluoroglass dosimeter and its standardization are described. The improved fluoroglass composed of mainly $LiPO_3$ and $Al(PO_3)_3$ contains 8% $AgPO_3$ and 3% B_2O_3. After this glass is exposed to radiation, fluorescence of 640 mμ is generated.

Kakuji Yamamoto and Masao Tsuchiya, Tokyo Metropolitan Isotope Center, Tokyo, Japan
ELECTRIC CHARACTERISTICS OF GAMMA-RAY IRRADIATED SHIELDING WINDOW GLASS
Journal of Applied Physics, 33, (10), Oct., 1962, pp 3016-3020
(Accession No. 18096)

Induced color of shielding window glass of various kinds by γ-ray irradiation is studied. With Cobalt-60 1 kc as radiation source, 23 $\pm$ 3 C as irradiation temperature, 10^5 R/h as exposure dose rate and 10^5-10^7 R as total exposure dose, the coloration increases gradually.

Ryesuke Yokota and Sabure Nakajima
THE HIGH-PERFORMANCE FLUOROGLASS DOSIMETER
University of California, Lawrence Radiation Lab., Berkeley, Calif., UCRL-TRANS-984, July, 1963, Translation from Toshiba Rebyu, 18, (2), 1963, pp 1-9
(Accession No. 24845)

As a result of a new optical system, measurement reproducibility has been considerably enhanced. Type FD-P-8-1 glass has accuracies of 15% for 10 mrad, 6% for 25 mrad and 2% for 50 mrad of γ-rays. Exposure-dose measurement with Type FD-R1-1 has been remarkably improved in accuracy and rendered quite insensitive to contamination.

REVIEW OF PAPERS PRESENTED AT OCTOBER CONFERENCE ON ELECTRICAL INSULATION
Insulation, Vol. 6, No. 12, December 1960, pp. 97-98, 100, 102, 104, 108, 111-112, 115
(Accession No. 13273)

Glasses tested were soda-lime-silicate (window) glass and boro-silicate glass, both coated with air-crying silver paint. It was concluded that gamma radiation has a negligible effect on the resistivity of the glasses measured, gamma radiation causes a current in the sample, and ordinary techniques may not be used to measure the effects of gamma radiation on the electrical conductivity on insulating materials.

EFFECT OF RADIATION ON MATERIALS
Materials in Design Engineering, 58, (5), Mid-Oct., 1963, pp 40-43
(Accession No. 21526)

This is a review article, which discusses in part the radiation effects on the following glasses: Phosphate Glasses, Special Glasses, Pure GeO_2 Glass, Lead Glass (window), Optical Glass (crown and flint), Optical Glass (proteced; contains 1-2% CeO_2), Fused Silica, Borosilicate, and Pyrex (borosilicate).

RUSSIANS STUDY RADIATION RESISTANT GLASSES
Missiles and Rockets, 13, (2), July 8, 1963, p 23
(Accession No. 20584)

Alkali window glass containing titanium and zirconium dioxide, and also barite glass with chromium- and zirconium-oxide additives have shown high resistance to gamma-neutron bombardment. The foam glasses, having a density of the order of 0.25-0.6 gm/cm, have withstood temperatures above 600°C. Specimens were subjected to hot neutron streams (10^{18} neutron/cm^2) in a reactor for 84 hours without experiencing loss of mechanical strength, the report claimed.

SOVIET RADIATION-RESISTANT FOAM GLASS
Nuclear Engineering, 8, (87), August, 1963, p 285
(Accession No. 20958)

The radiation resistance of some of the foam glasses obtained in laboratory conditions based on starting formulae for two types--ordinary window glass and a non alkali glass were tested. The compositions of the foam glasses obtained on the basis of these glasses and their relative heat resistance are shown. The specimens were subjected to radiation with hot neutrons in an atomic reactor for 84 hours. The integral stream of hot neutrons was about 10^{18} neutrons/cm^2. Results show that after irradiation the mechanical strength of the specimens of foam glass is scarcely altered.

TRANSCRIPT OF THE PHOTOVOLTAIC SPECIALISTS CONFERENCE. VOLUME II. REPORT ON SYSTEMS EXPERIENCE, APPLICATIONS, AND DESIGN
Papers presented at the Photovoltaic Specialists Conference, Washington, D.C., April 11, 1963, PIC-SOL-209/3.1, July, 1963, 210 pp
Available: NASA, X64-11311 to X64-11323 and DDC, AD 412463
(Accession No. 25398)

EFFECTS OF RADIATION ON COVER GLASSES AND COVER GLASSES AND ADHESIVES
Albert C. Lee, Space Technology Laboratories, Inc., Redondo Beach, California
Samples were electron irradiated to an exposure of 1 Mev.

NEEP NUCLEAR ELECTRONIC EFFECTS PROGRAM
Bell Telephone Laboratories, Inc., Whippany, N. J., ASD-TDR-62-189, Nov 15, 1961, Eighth Triannual Tech. Note, July 1 - Oct. 31, 1961, AF 33(616)-6235, 100 pp
Available: ASTIA
(Accession No. 16701)

Several experimental silicon diodes coated with low-melting glass and several vacuum-encapsulated diodes were exposed to a gamma dose of 9×10^7 roentgens. There was no significant permanent damage to the devices.

M&TC SYSTEM STUDY
Bendix Corp. Systems Div., Ann Arbor, Michigan, BSR-371, Dec. 1960, Final Rpt., Vol. II, AF 33(600)-35026
(Accession No. 15100)

This report summarizes performance characteristics determined by test or evaluation of random samples of various products including glass under extreme environmental conditions against which the products generally were not designed.

PROCESS RADIATION DEVELOPMENT PROGRAM SUMMARIES
Brookhaven National Laboratory, Upton, N. Y., BNL-790(C-37), April, 1963, Annual Contractors Meeting, April 22-23, 1963, 72 pp
Available: NASA, N63-18295, OTS
(Accession No. 22745)

A STUDY OF ELECTRICAL BREAKDOWN IN SHIELDING GLASS UNDERGOING INTENSE GAMMA IRRADIATION
Martin S. Zucker, Brookhaven National Laboratory.

IRRADIATION OF GLASS CAPACITORS
General Electric Co., Aircraft Nuclear Propulsion Dept., Radiation Testing Unit, DC-59-6-46, 28 May 1959, Preliminary Rpt., Cincinnati, Ohio, AF 33(600)-38062
(Accession No. 10730)

Two capsules containing glass dielectric capacitors (X-10-Y and X-10-Z), obtained from Corning Glass Works, were irradiated in the ORNL graphite reactor. Both capsules were exposed to an integrated neutron flux of 3.4×10^{18} NVT which accumulated during 1064 hours of reactor operation at 3600 KW over a period of 1169 hours in the reactor. Temperature was constant at 300°C. The test data reported herein indicate that glass dielectric capacitors will require circuit modification to obtain satisfactory performance. The report contains descriptions of each test, along with photographs and data sheets.

DATA OBTAINED FROM FIRST IRRADIATION TEST OF STRUCTURAL MATERIALS
General Tire & Rubber Co., Aerojet-General Corp., Azusa, Calif., AGC-2473, April 15, 1963, SNP-1, 309 pp
(Accession No. 23453)

Averages are presented of the ultimate strength and elongation for all [illegible]ic specimens for which valid data was obtained. For phenolic glass, there was no change in structure or color. Dose: 4×10^8 erg/gm(C). For silicone glass, there was apparent loss of density, definite structure damage, and fiber ends lost identity. Structure was much whiter and more brilliant. Dose: 3×10^6 erg/cm(C).

STUDY OF EFFECT OF HIGH-INTENSITY PULSED NUCLEAR RADIATION ON ELECTRONIC PARTS AND MATERIALS
International Business Machines Corp., FSD Space Guidance Center, Owego, N. Y., IBM-63-521-1, Rpt. No. 9, July 1 - Sept. 30, 1962, DA-36-039-SC-85395, 50 pp
Available: ASTIA
(Accession No. 18518)

The experiments performed during the fourth SPRF test series under Contract DA-36-039-SC-85395 were designed to verify that photoconductivity theory governed the principal pulse radiation effects in glass dielectric capacitors. To this end, four separate experiments were conducted in which a total of approximately 100 capacitors were irradiated. Post-test examination of the data, microscopic examination of dissected samples, and experiments conducted with the IBM 300-kv flash X-ray machine indicated that defects in the test samples caused variations in the radiation-induced effects.

NGL PLATFORM NUCLEAR RADIATION PROGRAM
Litton Systems, Inc. Beverly Hills, Calif., BH 59-3461.16, 15 Dec. 1960, Third Bimo. Rpt., 23 Sept. - 23 Nov. 1960, AF 33(600)-41452, 225 pp
Available: ASTIA
(Accession No. 13447)

2.0 MATERIAL RESEARCH AND ANALYSIS

The report considers the NGL materials and their ability to withstand the combined temperature and radiation environment of 131°F and a radiation of 1 (15) n/cm^2 at energies greater than 2.9 Mev accompanied by 1 (11) ergs/gm(C) of gamma.

SOLID STATE DIVISION ANNUAL PROGRESS REPORT
Oak Ridge National Laboratory, Solid State Div., Oak Ridge, Tenn., ORNL-2614, Issued: 20 Nov. 1958, Annual Prog. Rpt. for period ending 31 Aug. 1958, W-7405-eng-26, p 120
(Accession No. 8417)

RADIATION STABILITY OF CERAMIC MATERIALS C. D. Bopp

When plate glass was irradiated with 6×10^{20} nvt epithermal neutrons, the Knoop hardness number was increased more than three fold. It was determined that the temperature coefficient of the modulus was unchanged by irradiation within about $\pm$ 7%. The measurement was made at 1000 cps in the temperature range from -50 to 0°C. The insensitivity of the temperature coefficient of the modulus as compared with the Knoop hardness indicates that the change in Knoop hardness is not caused by a change in the elastic constants. This conclusion is in agreement with results obtained for another specimen exposed to 2×10^{19} nvt epithermal neutrons, whose dimensions were not altered so much as to prevent the measurement of the absolute value of the modulus.

CHEMICAL TECHNOLOGY DIVISION ANNUAL PROGRESS REPORT
Oak Ridge National Lab., Oak Ridge, Tenn., ORNL-2993, Issued: 26 Sept. 1960, Annual Prog Rpt. for Period Ending 31 Aug. 1960, W-7405-eng-26
(Accession No. 13173)

A number of protective coatings, hydraulic fluids, lubricants, plastics, and wood materials were irradiated in a Co-60 source of 2×10^6 r/hr intensity to total doses of 3×10^9 r to determine their suitability for use in various PREP applications. Glass-coated steel was irradiated to assess its suitability for radiochemical process service. The results of these tests are given.

SUMMARY REPORT
University of Chicago, Argonne National Laboratory, Lemont, Ill., ANL-6072, Summary Rpt., Oct.-Nov. 1959, W-31-109-eng-38
(Accession No. 11258)

Neutron Detectors L. M. Bollinger and G. E. Thomas
GLASS SCINTILLATORS FOR NEUTRON DETECTION

Two boron-containing glass scintillators were tested for use as detectors of slow neutrons. Glass composition and experimental data are given.